UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FENCE (Feet)
CODE 382

DEFINITION

A constructed barrier to livestock, wildlife or people.

PURPOSES

This practice may be applied as part of a conservation management system to facilitate the application of conservation practices that treat the soil, water, air, plant, animal and human resources concerns.

CONDITIONS WHERE THIS PRACTICE APPLIES

This practice may be applied on any area where livestock and/or wildlife control is needed, or where access to people is to be regulated. Fences are not needed where natural barriers will serve the purpose.

Applicable purposes include, but are not limited to:

- Improving distribution and timing of livestock grazing
- Reducing erosion and improving water quality by controlling livestock access to streams, springs, wetlands, and ponds.
- Facilitating handling, movement, and feeding of livestock
- Protecting newly planted areas from disturbance until established.
- Protecting sensitive environmental areas and their flora from vehicular, pedestrian, or animal traffic and use.
- Protecting the safety of people, livestock, and wildlife by limiting or denying access to hazardous areas.

Fencing material shall be high quality and durable, and the construction performed in a workmanship manner that meets the intended management objectives. Components for permanent fence shall meet or exceed the following minimum criteria:

CRITERIA

Fences shall be positioned to facilitate management requirements. Design and installation of all fences will comply with local, state, and federal laws.

All fences shall consist of acceptable fencing design and construction to control the animal(s) or people of concern and meet the intended management objectives and life of the practice.

Electrified fences will be identified with signs, particularly along roads, near houses, or others places where persons may come in contact with the fence.

Height, number, and spacing of wires will provide the desired control and management of the animal(s) and people of concern.

Fencing materials shall be high quality and durable, and the construction performed in a workmanship manner that meets the intended management objectives and topographic challenges of the site. Components for permanent fencing shall meet or exceed the following minimum criteria.

Wire

Barbed wire shall be standard galvanized double strand 12 1/2 gauge or high tensile steel class III galvanized 15 1/2 gauge double strand barbed wire. Barbed wire will not be used for electrified fence because of safety hazard.

Woven wire shall have at least 12 1/2 gauge top and bottom strands, with 14 1/2 gauge intermediate and stay wires which are spaced not more than 12 inches apart with standard galvanize coating or be high tensile 14 1/2 gauge class III galvanized.

Smooth wire for high tensile permanent fencing (electrified and non-electrified) shall be at least 12 1/2 gauge high tensile steel with a tensile strength of 180,000 psi and class III galvanized or aluminum coating.

Wire used in bracing shall be double strand 9 gage galvanized smooth wire or double strand barbed wire.

All wire shall be new galvanized or aluminum coated.

Staples and Clips

Staples shall be of 9-gauge (bright) hard wire, and a minimum of one and one-half inches long for soft woods and one inch for hard woods. Factory clips designed for steel post or 16 gauge galvanized wire may be used for steel post. Install staples or clips so that wire can slide easily.

Post

Type, height, size, and spacing of posts will be used that best provides the needs for the style of fences required and is best suited to the topography of the landscape.

Wooden post and braces may be red cedar heartwood, pine heartwood, Osage orange, black and honey locust, catalpa, and mulberry. Pine and other species may be used provided they have been treated as indicated below:

Treatment	Retention lb/ft3
creosote coal tar*	6.0
pentachlorophenol*	0.3
acid copper chromate	0.5
amoniacal copper arsenite	0.4
chromated copper arsenate	0.4

*Post treated with these materials are legal and acceptable; however availability is limited because waste products from the treatment process are classified as hazardous wastes. Post and other timbers treated with these materials could also be classified as hazardous wastes after their useful life has expired.

Wooden line post shall be at least three (3) inches in diameter in side of bark (1/2 inch variance) and sufficient length to meet fence height requirements and be set at least 20 inches in the ground. There will be at least two inches of post above the last strand of wire.

Metal post shall be standard T or U section high carbon steel weighting not less than 1.25 pounds per foot of length. They will have an anchor plate and be studded, embossed or punched for wire attachment. Metal post will be galvanized, enameled and baked, or painted with weather resistant steel paint. They shall be of sufficient length to meet fence height requirements and be set at least 20 inches deep in the ground.

Australian iron wood (eucalyptus), fiber glass Tpost, fiber glass sucker rod and other insulating post may be used for electrified line fence. They shall be of sufficient length to meet fence height and be anchored at least 20 inches deep in the soil.

Line post for non-suspension fence may be spaced up to 40 feet apart if stays are used at 10 foot intervals between them. Otherwise, line posts will be spaced no farther apart than 16 feet. Line post for suspension fence (high tensile; electrified and non-electrified) are not to exceed 100 foot spacing with suitable stays placed at 33 to 50 feet intervals.

Corner and gate posts shall be of sufficient length to meet fence height requirements and be set at least 36 inches in the ground. Wood posts shall be five inches diameter (1/2 variance). Red cedar posts shall have heartwood at least three inches in diameter. Steel pipe must be at least three inches in diameter and weight at least 7 pounds per linear foot, and have a water tight end cap. Steel corner and gate posts will be set in concrete. Concrete will fill the post hole and be slightly rounded on top, surrounding the post. All metal posts will be galvanized or painted with a rust-resistant coating and repainted if rusting occurs.

Pull post shall be at least 4 inches in diameter (1/2 inch variance) and sufficient length to meet requirements of fence. Pull post will be set at least 36 inches deep.

Trees may be used in rocky areas where post holes are impossible to dig or in frequently flooded areas where fences are difficult to maintain. Use low value trees for posts. Trees should be properly aligned and sufficient size that swaying and other movements will not affect the operation of the fence. When trees are used, a buffer (treated board) should be installed between the wire and the tree to keep the tree from growing around the wire. In places where a buffer cannot be attached to the tree, the staples driven directly into the tree must completely penetrate the sapwood below the bark.

Bracing and Pull Post Assemblies

Braces and end assemblies are required at all corners, gates, and definite angles in the fence. Bracing consisting of single post end, corner, or angle slip brace assembly, deadmaned 2 or 3 post end, corner or angle brace assembly or equivalent strength will be used.

Line bracing or pull post assembly spacing for non-suspension fence will depend on the terrain with the maximum spacing for straight level sections of fence being 660 feet. "H" brace or single post pull assemblies or an equivalent strength pull assembly will be used.

Offset Brackets

Offset brackets made of galvanized high tensile spring wire with insulator of high density polyethylene with ultra-violet stabilizer or porcelain can be attached to standard fence to provide a transmission line and/or to electrify a standard fence. Place offset brackets no further than 80 feet apart. If control of animals is desired, place offset brackets at 2/3 the height of the animals to be controlled. Insure that no wires of the old fence come in contact with the electric fence wire as a short will occur.

Gates and Flood Gates

Gates and flood gates shall equal or exceed quality of adjoining fence. When non-electrified gates are used with electrified fence, then under ground transmission lines will be used to carry electricity past the gate to the remainder of the fence. Double Insulated Cable, Leadout Cable, or High Conductive Leadout Cable will be used for both the live and ground return wires under ground. The under ground cable will be installed at least 12 inches deep and will be laid in a plastic pipe for physical protection.

The ends of the pipe will be turned down to keep the water out.

Electrified gates may be constructed of a single straight wire with a spring loaded insulated handle, an electric swinging drive-through gate, or an expandable, coiled, high tensile, 12 1/2 gauge wire attached to an insulated handle. However, more wires may be used, depending on the gates objective. All electrified gates will be constructed according to the manufacturers' directions and specifications.

An electrified flood gate may be used in lieu of a non-electrified gate. Install electrified flood gates according to the manufacturers' directions and specifications. Electrified flood gates will have a flood gate controller between fence and the flood gate.

Energizers

Energizers shall be high voltage, low impedance, short pulse (less than 300 millionths, .0003, of a second) and will produce at least 4000 volts output when all fences are charged and under maximum anticipated load.

Energizers shall be 110 volt, 220 volt, or 12 volt battery powered. As a rule of thumb one joule of energy is needed for each mile of planned fence. They shall be equipped with a safety pace fuse. A surge protector will be installed for protection of the 110 volt or 220 volt energizers.

Energizers shall be contained in a high impact weather resistant case unless maintained inside a building. Ground rods will be installed at the electrical circuit breaker box, if they do not exist. Grounding of energizers and installation of lighting diverters or arresters shall be according to the manufacturers' directions and specifications.

Insulators and Insulated Cable

Insulators for steel and other conductive material posts must be high density polyethylene with ultra-violet stabilizer, high density polypropylene with ultra-violet stabilizer or porcelain that withstands 10,000 volts or more current leakage. Insulators must have a long tracking distance, and at least 2/5 inch of material between the live wire and supporting post. Wrap-around tube insulators must not have metal lining.

Insulated cable for underground burial shall be galvanized wire with two layers of insulation. The insulation must be high density polyethylene with ultra-violet stabilizer or high density polypropylene with ultra-violet stabilizer. Do not use copper wire due to corrosion.

Temporary electrified fences may be used to subdivide permanently fenced pastures. Electro-plastic twine or tape for temporary electrified fence shall be woven with at least 6 aluminum or stainless steel strands for distances up to 1/2 mile. For distances up to 1 mile at least 9 wire filaments will be used.

Other wire for temporary fence shall be at least 14 gauge smooth steel or aluminum. Temporary fence line posts that have good insulation value and are reasonably easy to move should be used. Examples are: fiberglass "tee" post, insultimber post, 3/8 inch fiberglass rods, plastic "step-in" post, etc. The spacing and height of post should be such as to keep the fence at the desired height.

Other criteria and components of temporary fence such as insulators, wire quality, and energizers will be the same as the permanent energized fence criteria.

CONSIDERATIONS

Consider installing fences in locations that will facilitate maintenance by avoiding irregular terrain and/or water crossings. Fences should be constructed in flood prone areas only when necessary.

Consider livestock management, handling, watering and feeding when locating fences as well as management of the forage resources. Size and arrangement of grazing units to be created by fencing should be consistent with improvements through FOTG Standard Prescribed Grazing-528A.

Gates should be placed at corners or other convenient locations to facilitate livestock movement. Also, where possible, position gates on flat, firm areas and away from steep banks where erosion can occur. Gates wider than normal should be used with fences planned for intensified grazing system to facilitate handling large numbers of livestock. Consider installing heavy use area protection (561) at gates to protect the high traffic area.

Consider wildlife movement needs when locating fences. In white-tailed deer range, consideration should be given to spacing the top two wires at least 10 inches or more apart to reduce the hazard of deer being caught in the fence.

Use the type of fence that is best suited to the kind of livestock operation planned.

Temporary fences are used to subdivide land on a temporary basis within grazing areas to permit the implementation of a planned grazing system or to provide for the temporary exclusion of livestock as part of a riparian areas or to temporarily exclude livestock from areas needing grazing protection until seedling establishment.

Permanent fences are used to exclude livestock from all areas needing permanent protection and/or used to establish permanent grazing boundary areas.

Where applicable, cleared rights-of-way will be established to facilitate fence construction and maintenance.

Consider soil erosion potential when planning and constructing a fence on steep slopes.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for specific fields sites based on the NRCS National and State Fence Standards and appropriate state or local statutes or laws.

OPERATION AND MAINTENANCE

Regular inspection of fences, especially electrified fences to minimize shorts, will be a part of an on-going management program. Weeds and other vegetation will have to be controlled under electrified fences to minimize loss of power. Inspection of fences after storm events is needed to facilitate the function of the intended use of the fence.

Electrified fence voltage should be checked weekly and immediately after lightning storms with a fence tester. This is especially important for battery operated or solar power energizer system.

Wire tension and spacing must be maintained at all times. Tension adjustments for seasonal temperature changes should be made as needed. Also, tension adjustments may be necessary after fence repairs. Tensioners should be located midway between wire runs and staggered on the wire strands.

Maintenance and repairs will be performed as needed to facilitate the intended operation of the installed fence.

REFERENCES

Alabama Cooperative Extension Service Publication SR 7004 Southern Regional Beef Management Handbook - Wire Fences.

Gallagher Power Fence Manual. 10th Edition.

Georgia Cooperative Extension Service Circular 774. Fences For The Farm.

High-Tensile Wire Fencing. Northeast Regional Agricultural Engineering Service. Ithaca, NY.

US Army Corps of Engineers Technical Report EL-86-7. Impassable Wire Fences.

US Army Corps of Engineers Technical Report EL-86-16. Special Wire Fences.

1997 Missouri Grazing Manual. Edited by Jim Gerrish & Craig Roberts.

The University of Tennessee Agricultural Extension Service, Publication PB 1541. Planning and Building Fences on the Farm.

Wood Handbook, USDA, Forest Service, Forest Products Laboratory. (http://www.fpl.fs.fed.us/DOCUMNTS/FPLGTR/fplgtr113/fplgtr113.htm.

Fences for the Farm. University of Georgia. Cooperative Extension Service. Bulletin 119